Claim Objections

Claims 30-32 were objected to for being based upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. The limitations of claim 30 have been added to independent claim 21, and claim 30 has been canceled. Applicants submit that this amendment overcomes the objections given by the Examiner. As such, Applicants respectfully request that this objection be withdrawn, and that claims 30-32 be allowed.

35 U.S.C. § 102(b) rejections

Claims 1-20 stand rejected under 35 U.S.C. § 102(b) as being anticipated by DeWitt. Applicants respectfully disagree with the Examiner's conclusion and submit that the present invention is not anticipated, nor even suggested, by DeWitt.

As presently claimed by Applicants, Applicants' invention comprises "[a]n apparatus for the rapid screening of potential reactants, catalysts or reaction conditions, the apparatus comprising ... a head plate positioned to provide a ***sealed pressurized headspace*** ... said sealed pressurized headspace having an adjustable pressure in a range of between about 1 atmosphere and about 50 atmosphere."[1] These amendments are fully supported by Applicants' specification at original claims 5, 16 and 30, as well as at page 6, lines 19-20; page 9, lines 1-5; and page 11, lines 6-11, among other places.

In contrast, DeWitt does not disclose an apparatus for the rapid screening of potential reactants, catalysts or reaction conditions at high pressures. In fact, DeWitt's apparatus can only be used for reactions at ambient pressures. Furthermore, the pressure equalization features of DeWitt are provided only to equalize any minor pressure variations that may develop within the reactor system during the course of a reaction (i.e., due to the evolution of any gaseous products from the reactions).[2] The only other application of gas pressure in the DeWitt apparatus is to help expel the liquid solvents from the reaction tubes after the reaction is complete.[3] In fact, some of the materials that the DeWitt apparatus is constructed with are incompatible with high-pressure operation

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1 Applicant's spec., independent claims 1 and 14 (emphasis added).
2 DeWitt, col. 17, lines 9-12; col, 23, lines 1-9; and Fig. 16 (openings 260).
3 DeWitt, col. 13, lines 34-40; col. 14, lines 5-12; and col. 14, lines 42-48.

(i.e., glass, plastic, etc.).[4] The DeWitt apparatus could not even be modified to accommodate high-pressure reactions since the entire design, materials of construction, and additional features (i.e., robotic liquid delivery and sample removal) are incompatible with high-pressure operation. Therefore, DeWitt does not anticipate, nor even suggest, an apparatus for the rapid screening of potential reactants, catalysts or reaction conditions at high pressures, as recited in independent claims 1 and 14 of Applicants' invention.

Based on the above arguments and amendments, Applicants respectfully submit that independent claims 1 and 14 of the present invention are patentably distinguished from DeWitt. As claims 2-13 depend from claim 1, and claims 15-20 depend from claim 14, the discussion above applies to these claims as well. Further, these claims each include separate novel features. Thus, Applicants respectfully request allowance of pending claims 1-20.

35 U.S.C. § 103(a) rejections

Claims 21-29 stand rejected under 35 U.S.C. §103(a) as being unpatentable over DeWitt. Applicants respectfully disagree with the Examiner's conclusion and submit that the present invention is not obvious in view of, nor is it even suggested by, DeWitt.

As presently claimed in Applicants' independent claim 21, Applicants' invention comprises "[a] method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising: adding a plurality of reactant systems at least partially embodied in liquid to a reaction substrate ... wherein said plurality of reactant systems at least partially embodied in liquid each comprises a film having a thickness L."[5] The amendment to this claim is supported by Applicants' original claim 30, which the Examiner noted would be allowable if rewritten in independent form to include all the limitations of its base claim.

Based on the above arguments and amendments, Applicants respectfully submit that independent claim 21 of the present invention is now patentably distinguished from DeWitt. As claims 22-29 depend from claim 21, the discussion above applies to these

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4 DeWitt, col. 8, line 43 to col. 9, line 9.

5 Applicants' spec., independent claim 21.

claims as well. Further, these claims each include separate novel features. Thus, Applicants respectfully request allowance of pending claims 21-29.

CONCLUSION

Applicants respectfully submit that the amendments to the claims successfully traverse the rejections and objections given by the Examiner in this Office Action. For the above reasons, it is respectfully submitted that the claims now pending patentably distinguish the present invention from the cited reference. Allowance of pending claims 1-4, 6-15, 17-29 and 31-38 is therefore respectfully requested.

As this reply is being timely filed within 4 months from the mailing date of this Office Action, Applicants believe that the only fee due for this response is for the filing of a one month extension of time. Payment in the amount of **$110** is enclosed for this. If this amount is incorrect, however, the Commissioner is authorized to charge any additional fees that may be due, or credit any overpayment, to **Deposit Account No. 04-1448**.

Should the Examiner have any questions, or determine that any further action is necessary to place this Application into better form for allowance, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

Respectfully submitted,

Date: 02/03/03

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Amendments in the Specification:

In accordance with 37 C.F.R. § 1.121(b), the following replacement paragraphs show all of the changes made by the foregoing amendments relative to the previous versions of the paragraphs. Material added is shown underlined, material deleted is shown in [brackets].

Please amend the second full paragraph on page 7 as follows:

In a preferred embodiment, reaction substrate 4 is positioned adjacent to, and in thermal communication with, a thermal unit 8. Thermal unit 8 adjustably maintains reaction substrate 4 at one or a series of temperatures, thereby heating or cooling the samples or reactant systems within substrate reservoir 6. Thermal unit 8 includes a thermally conductive material and a heating source 30 and a cooling source 20 to maintain the reaction temperature within a desired range. Preferably, thermal unit 8 is adjacent to at least one surface of reaction substrate 4. For example, in the embodiment shown in Fig. 2, reaction substrate 4 sits directly on thermal unit 8. Thermal unit 8 is preferably formed of a thermally conductive material, such as copper or aluminum or other suitable materials. More preferably, thermal unit 8 is in thermal communication with reaction substrate 4 such that variations in the temperature of thermal unit 8 are quickly transmitted to the reaction zone 28 in substrate reservoir 6. Although shown as separate components, reaction substrate 4 and thermal unit 8 may [by] be integrally formed. Heating source 30 includes cartridge resistance heaters 30 mounted horizontally within the thermal unit 8, although other heating sources may be utilized. Cooling source 20 includes a pump 18 delivering a cooling agent 34 such as water or freon through a serpentine channel 32 within thermal unit 8 (Fig. 2), although other cooling sources may be utilized. As described above for reaction substrate 4, multiple resistance temperature detectors 26 can be mounted at various locations within thermal unit 8 in order to monitor temperature variations.

Please amend the second full paragraph on page 14 as follows:

As an example, and again referring to Fig. 5, an embodiment of an aspect of the invention comprises the following steps. Thermal unit 8 and base plate 52 are assembled, and reaction substrate 4 is positioned on top of thermal unit 8 (step 1). A predetermined amount of reactants 28 at least partially embodied in a liquid comprising a film thickness L are added to individual reaction vials 24. The invention contemplates that the use of individual reaction vials will enable multiple reagents or catalysts to be tested in one experiment. The vials 24 are sealed with a septum cap 72 and placed in wells 6 in reaction substrate 4 (step 2). Head plate 10 is then lowered on to reaction substrate 4 with the aid of counterweight system 60 (see Fig. 4) and positioned so that base plate studs 54 can be fastened to head plate 10 (step 3). Once a seal between head plate 10 and reaction substrate 4 has been established, controller 70 is used to heat thermal unit [(8)] 8 (step 4). Gas 46 is pumped from gas supply 38 into head space 12 to establish an atmosphere of predetermined pressure (step 5). The gas may be a gas inert to the reaction, or may comprise a second reactant. The invention contemplates that the atmosphere in the headspace outside of the reaction vial 12 will equilibrate with the atmosphere inside the reaction vial 76, thereby presenting gaseous reactants 46 to each set of liquid reactants presented in each vial. Computer 70 controlled resistance temperature detectors 26 enable precise control of the temperature of the reaction substrate, thermal unit and head plate. Surface heaters 40 on the head plate 10 are adjusted to prevent condensation of gas 46 in the headspace 12 (step 6). To terminate the reaction, heaters 30 in thermal unit 8 are turned off and a cooling agent 34 is pumped through channels 32 in the thermal unit 8. Once the reaction substrate 4 is cooled, the head plate 10 is removed with the aid of the counterweight 60 (Fig. 4), and reaction vials 24 are removed for subsequent analysis.

Amendments in the Claims:

In accordance with 37 C.F.R. § 1.121(c)(1), the following replacement claims show all of the changes made by the foregoing amendments relative to the previous versions of the claims. Material added is shown underlined, material deleted is shown in [brackets].

1. (Amended) An apparatus for the rapid screening of potential reactants, catalysts or reaction conditions, the apparatus comprising:

a reaction substrate comprising at least one substrate reservoir, said reaction substrate having a first temperature; and

a head plate positioned to provide a sealed pressurized headspace adjacent to said substrate reservoir, said head plate having a second temperature and said sealed pressurized headspace having an adjustable pressure in a range of between about 1 atmosphere and about 50 atmosphere.

4. (Amended) The apparatus of claim 1, further comprising a gas source in communication with said sealed pressurized headspace, wherein said gas source includes at least one gas.

5. CANCEL

6. (Amended) The apparatus of claim [5] 1, wherein said adjustable pressure comprises a range of between about 1 atmosphere and about 45 atmosphere.

13. (Amended) The apparatus of claim 12, wherein said at least one reactant system comprises the atmosphere in said sealed pressurized headspace.

14. (Amended) An apparatus for the rapid screening of potential reactants, catalysts and reaction conditions, the apparatus comprising:

a reaction substrate comprising a plurality of substrate reservoirs;

a thermal unit in communication with said substrate reservoir to adjustably heat and cool said reaction substrate;

a head plate positioned to provide a sealed pressurized headspace adjacent to said plurality of substrate reservoirs, wherein said sealed pressurized headspace comprises a high pressure seal between said head plate and said reaction substrate and wherein said sealed pressurized headspace comprises an adjustable pressure in a range of between about 1 atmosphere and about 50 atmosphere;

a plurality of temperature detectors, wherein at least one of said plurality of temperature detectors is positioned within each of said reaction substrate and said head plate;

a controller in communication with said plurality of temperature detectors, wherein said controller adjusts a temperature of said thermal unit to maintain said reaction substrate at a first temperature, and wherein said controller maintains said head plate at a second temperature; and

a plurality of reactant systems wherein each one of said plurality of reactant systems is positioned within a corresponding one of said plurality of substrate reservoirs, and wherein each of the plurality of reactant systems is at least partly embodied in a liquid film having a thickness L.

15. (Amended) The apparatus of claim 14, further comprising a gas source in communication with said sealed pressurized headspace, wherein said gas source includes at least one gas.

16. CANCEL

17. (Amended) The apparatus of claim [16] 14, wherein said sealed pressurized headspace comprises a pressure ranging from about 1 atmosphere to about 45 atmosphere.

18. (Amended) The apparatus of claim 17, wherein said sealed pressurized headspace comprises a pressure ranging from about 1 atmosphere to about 20 atmosphere.

21. (Amended) A method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising:

adding a plurality of reactant systems at least partially embodied in liquid to a reaction substrate comprising a plurality of substrate reservoirs, wherein the reaction substrate has an adjustable first temperature;

maintaining an adjustable pressure in a sealed headspace in communication with the reactant system;

adding a gas to the sealed headspace wherein the gas equilibrates with each of the plurality of liquid reactant systems; and

maintaining said headspace at a second temperature[.],

wherein said plurality of reactant systems at least partially embodied in liquid each comprises a film having a thickness L.

30. CANCEL

31. (Amended) The method of claim [30] 21, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of a gaseous reactant into the liquid reactant system.

32. (Amended) The method of claim [30] 21, wherein said thickness L is sufficient to allow the reaction to be independent of effects of evaporation of the liquid reactant system.

33. (Amended) A method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising:

adding a plurality of reactant systems to a reaction substrate, wherein the reaction substrate has an adjustable first temperature, and each of the plurality of reactant systems

is at least partly embodied in a liquid film having a thickness L, wherein said thickness L is sufficient to allow the reaction to be independent of evaporation of the liquid film and the mass transport rate of a gas into the liquid;

maintaining an adjustable pressure in a sealed headspace in communication with the reactant system;

adding said gas to the sealed headspace, wherein said gas equilibrates with each of the plurality of liquid reactant systems; and

maintaining the sealed headspace at an adjustable second temperature wherein the second temperature of the headspace is greater than the first temperature of the substrate reservoir[;].

CLEAN VERSION OF ALL PENDING CLAIMS

In accordance with 37 C.F.R. § 1.121(c)(3), the following is a clean version of all currently pending claims as of the filing of this response.

1. (Amended) An apparatus for the rapid screening of potential reactants, catalysts or reaction conditions, the apparatus comprising:

a reaction substrate comprising at least one substrate reservoir, said reaction substrate having a first temperature; and

a head plate positioned to provide a sealed pressurized headspace adjacent to said substrate reservoir, said head plate having a second temperature and said sealed pressurized headspace having an adjustable pressure in a range of between about 1 atmosphere and about 50 atmosphere.

2. The apparatus of claim 1, further comprising a controller in communication with said reaction substrate and said head plate, wherein said controller maintains said reaction substrate at said first temperature and said head plate at said second temperature.

3. The apparatus of claim 1, further comprising;

a thermal unit in communication with said reaction substrate and

a controller in communication with said reaction substrate and said head plate, wherein said controller adjusts the temperature of said thermal unit to maintain said reaction substrate at said first temperature and wherein said controller adjusts the temperature of said head plate to maintain said head plate at said second temperature.

4. (Amended) The apparatus of claim 1, further comprising a gas source in communication with said sealed pressurized headspace, wherein said gas source includes at least one gas.

5. CANCELED

6. (Amended) The apparatus of claim 1, wherein said adjustable pressure comprises a range of between about 1 atmosphere and about 45 atmosphere.

7. The apparatus of claim 6, wherein said adjustable pressure comprises a range of between about 1 atmosphere and about 20 atmosphere.

8. The apparatus of claim 1, further comprising at least one reactant system within at least one substrate reservoir, said reactant system being at least partially embodied in a liquid.

9. The apparatus of claim 8, wherein said at least one reactant system comprises a film having a thickness L.

10. The apparatus of claim 9, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of a gas into said liquid.

11. The apparatus of claim 9, wherein said thickness L is independent of the effects of evaporation of said liquid.

12. The apparatus of claim 1, wherein at least one reactant is partially embodied in a gas.

13. (Amended) The apparatus of claim 12, wherein said at least one reactant system comprises the atmosphere in said sealed pressurized headspace.

14. (Amended) An apparatus for the rapid screening of potential reactants, catalysts and reaction conditions, the apparatus comprising:

a reaction substrate comprising a plurality of substrate reservoirs;

a thermal unit in communication with said substrate reservoir to adjustably heat and cool said reaction substrate;

a head plate positioned to provide a sealed pressurized headspace adjacent to said plurality of substrate reservoirs, wherein said sealed pressurized headspace comprises a high pressure seal between said head plate and said reaction substrate and wherein said sealed pressurized headspace comprises an adjustable pressure in a range of between about 1 atmosphere and about 50 atmosphere;

a plurality of temperature detectors, wherein at least one of said plurality of temperature detectors is positioned within each of said reaction substrate and said head plate;

a controller in communication with said plurality of temperature detectors, wherein said controller adjusts a temperature of said thermal unit to maintain said reaction substrate at a first temperature, and wherein said controller maintains said head plate at a second temperature; and

a plurality of reactant systems wherein each one of said plurality of reactant systems is positioned within a corresponding one of said plurality of substrate reservoirs, and wherein each of the plurality of reactant systems is at least partly embodied in a liquid film having a thickness L.

15. (Amended) The apparatus of claim 14, further comprising a gas source in communication with said sealed pressurized headspace, wherein said gas source includes at least one gas.

16. CANCELED

17. (Amended) The apparatus of claim 14, wherein said sealed pressurized headspace comprises a pressure ranging from about 1 atmosphere to about 45 atmosphere.

18. (Amended) The apparatus of claim 17, wherein said sealed pressurized headspace comprises a pressure ranging from about 1 atmosphere to about 20 atmosphere.

19. The apparatus of claim 14, wherein at least one reactant is partially embodied in a gas.

20. The apparatus of claim 19, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of said gas into said liquid and evaporation of said liquid.

21. (Amended) A method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising:

adding a plurality of reactant systems at least partially embodied in liquid to a reaction substrate comprising a plurality of substrate reservoirs, wherein the reaction substrate has an adjustable first temperature;

maintaining an adjustable pressure in a sealed headspace in communication with the reactant system;

adding a gas to the sealed headspace wherein the gas equilibrates with each of the plurality of liquid reactant systems; and

maintaining said headspace at a second temperature,

wherein said plurality of reactant systems at least partially embodied in liquid each comprises a film having a thickness L.

22. The method of claim 21, wherein the second temperature is greater than the first temperature.

23. The method of claim 21, further comprising providing an external controller, wherein the controller maintains the reaction substrate at said first temperature and the headspace at the second temperature.

24. The method of claim 21, wherein said plurality of reactant systems each comprises reactants dissolved, suspended, submersed, or entrained in said liquid.

25. The method of claim 21, wherein the adjustable pressure in said sealed headspace is in the range of between about 1 atmosphere and about 50 atmosphere.

26. The method of claim 25, wherein the adjustable pressure in said sealed headspace is in the range of between about 1 atmosphere and about 45 atmosphere.

27. The method of claim 26, wherein the adjustable pressure in said sealed headspace is in the range of between about 1 atmosphere and about 20 atmosphere.

28. The method of claim 21, wherein at least one reactant system is partially embodied in said gas.

29. The method of claim 21, wherein the gaseous reactant comprises the atmosphere in the headspace over the reaction substrate.

30. CANCELED

31. (Amended) The method of claim 21, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of a gaseous reactant into the liquid reactant system.

32. (Amended) The method of claim 21, wherein said thickness L is sufficient to allow the reaction to be independent of effects of evaporation of the liquid reactant system.

33. (Amended) A method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising:

adding a plurality of reactant systems to a reaction substrate, wherein the reaction substrate has an adjustable first temperature, and each of the plurality of reactant systems is at least partly embodied in a liquid film having a thickness L, wherein said thickness L

is sufficient to allow the reaction to be independent of evaporation of the liquid film and the mass transport rate of a gas into the liquid;

maintaining an adjustable pressure in a sealed headspace in communication with the reactant system;

adding said gas to the sealed headspace, wherein said gas equilibrates with each of the plurality of liquid reactant systems; and

maintaining the sealed headspace at an adjustable second temperature wherein the second temperature of the headspace is greater than the first temperature of the substrate reservoir.

34. The method of claim 33, further comprising externally controlling said first and second temperatures.

35. The method of claim 33, wherein said defined pressure in said enclosed headspace is in the range of between about 1 atmosphere and about 50 atmosphere.

36. The method of claim 35, wherein said defined pressure in said enclosed headspace is in the range of between about 1 atmosphere and about 45 atmosphere.

37. The method of claim 36, wherein said defined pressure in said enclosed headspace is in the range of between about 1 atmosphere and about 20 atmosphere.

38. The method of claim 33, further comprising at least one reactant partially embodied in said gas.